

YOU'VE GOT THE HOOK:

Droppin' Science on School Libraries and the Future of Learning

BY MARCIA A. MARDIS

Many LIBRARY MEDIA CONNECTION readers may not be avid rap fans, but I am. What keeps me listening to this controversial, often brilliant but sometimes artless, musical genre? Smart lyrics and a good hook always make me want to hear more of a song and more work by the artist. The hook keeps me coming back.

In this time of change in our society, children's needs, preferences, and interactions with the world are changing. These changes have sent education policymakers scrambling to two extremes. The first extreme, a focus on testing and basic skills, seeks to ensure that all children leave school with equal knowledge and preparation for the workplace. The other extreme focuses on affective goals of helping children become good stewards of the environment, conscious participants in a democratic society, and technology-enabled individuals with dispositions that allow them to weather personal, economic, and cultural challenges.

Nowhere else in schools is the tension between these two approaches to education seen more starkly than in science education, and no other context is as underappreciated as a revolutionizing force in science learning as school libraries. Maybe it's time for us to take a fresh look at our hook (and yes, I meant that to rhyme) by working within innovative science learning trends.

WHAT DO WE KNOW ABOUT SCIENCE LEARNING IN THE UNITED STATES?

If "scientifically based research" and "adequate yearly progress" were the rallying cries for education policy over the past eight years, then the new calls of the Obama-era are "connection," "motivation," and "innovation." As new policies are unveiled, it is clear that they represent a break from a single-minded focus on decisions based on student achievement based on data-driven studies in which children are randomly assigned to either control or experimental groups. The new national focus on educational innovation means marrying practical

knowledge and lifelong relevance with observable gains in student learning.

During his campaign, President Obama advocated for a doubling of the federal funding for educational research and development by the end of his first term. Likewise, U.S. Secretary of Education Arne Duncan has spoken of innovations in charter schools, teacher incentives, and high school retention programs to improve public education. The American Restoration and Recovery Act (ARRA), the economic stimulus bill, includes large amounts of funds for states to invest in teacher training, school infrastructure improvement, broadband upgrades, and educational technology updates.

These policy changes are taking place in light of relatively stagnant science achievement in our schools. While the 2007 *Trends in International Mathematics and Science Study* (TIMSS) results showed that the United States is faring well in science achievement internationally, the National Science Board pointed out that longitudinal studies demonstrate persistent achievement gaps that fall on racial and socioeconomic differences (7). Student achievement in science has been declining over the last decade as children progress from fourth to twelfth grade (7). More than half of our scientific labor force is not educated in the United States, despite a growing need for more college graduates with science-related education and training (7). While some of our kids might be doing well enough in science, they are not maintaining an interest long enough to pursue careers in science-related fields.

WHAT DO WE KNOW ABOUT SCIENCE IN THE SCHOOL LIBRARY?

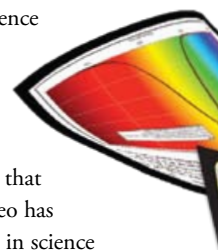
Building science collections has proven particularly challenging for many media specialists. Many lack formal education in science. Scientific information changes very quickly and content in published books is often outdated. Staying abreast of developments in science to

maintain a current collection is probably the most daunting task a media specialist faces.

In 2007, my colleague at University of Hawaii, Ellen Hoffman, and I studied the science collections of middle school libraries in Michigan (6). Science books as old as 40 years were on many school library shelves! In another study, I also found that many media specialists did not feel confident selecting science materials and often tolerated old and inherited science collections (4). This lack of confidence also affected media specialists' willingness to forge relationships with science teachers. Despite this lack of action, many media specialists told me that they wanted to build better science collections but lacked the budget funds to add more up-to-date periodicals, databases, and video resources to their collections (4). However, in another study, I found that non-book media like streaming video has the potential to address deficiencies in science book collections with current, dynamic, and affordable open content materials, if the school had adequate bandwidth (5).

While collection development in science can be challenging, collaboration between science teachers and media specialists can be even more fraught. A few years ago, I studied science teachers' perceptions of school libraries and found that though many science teachers struggled to find high quality science resources, they were not aware that the media specialist could help them locate digital as well as print science resources. And, science teachers did not perceive the media specialist as someone who could help them engage their computer-savvy students with interactive, visual, and up-to-date science resources (3).

In a time when we cannot educate enough scientists to meet our national needs, our children are not inspired to learn about science, and we lack the collections and collaborations to motivate more and better science learning, we need to look ahead in this vital area to see what the future can offer as a solution to these problems.





WHAT'S AHEAD FOR SCIENCE LEARNING?

We must link our technology-rich and interest-poor children to new ways of becoming excited about science. It doesn't seem like we're able to inspire students with tests or with our collections. We can't keep singing the same old library song; we need fresh lyrics for science learning. Here are trends in resources, technology, and learning that just might give you a new science hook.

Learning objects are independent, reusable pieces of digital content that meet an instructional objective. Usually found through digital libraries like the *National Science Digital Library*

(www.nsdli.org), learning objects can be videos, simulations, documents, audio files, or any other media. Learning objects may be tagged with metadata (like a catalog record) that describes how to use the object to meet an instructional objective, integrate the object into a learning activity, and assess the student learning gained from the object's use. WGBH's *Teachers' Domain* (<http://teachersdomain.org>) is a great collection of free learning objects accompanied by lesson plans, assessment strategies, and often the ability to download, edit, and combine videos, documents, simulations, and other media.

Cyberinfrastructure links computing systems, data, information resources, high-speed broadband networking, digitally enabled-sensors, instruments, virtual organizations, and observatories with software services and tools to get students thinking outside the traditional learning model. Cyberinfrastructure learning environments encompass classrooms, laboratories, libraries, galleries, museums, zoos, workplaces, and many other locations. When cyberinfrastructure is implemented widely, preschool, K-12, and college will be interconnected in an open learning world where people learn as a routine part of life, throughout their lives. Cyberinfrastructure extends the impact of science to citizens by enhancing communication about scientific inquiry and outcomes to the public. Such informal learning opportunities answer numerous needs, including those of parents involved with their children's schooling and those of adults with developmental, medical, financial, and social challenges.

Essential to cyberinfrastructure is a high-speed, broadband-enabled networked learning environment that allows students to discover content in all media, to assemble knowledge products in all media types, and communicate freely, yet responsibly, across the world. Find out more about cyberinfrastructure in the National Science Foundation's 2007 publication entitled *Cyberinfrastructure Vision for 21st Century Discovery* (8).

Informal learning operates across a broad range of venues like museums, state parks, and after-school programs. While informal learning can be organized around a number of topics like fine arts, community-building, and sports, informal science education is a very hot area at the moment, especially as it can be used to increase kids' interest in scientific phenomena, science careers, and ecological awareness. In a future linked through cyberinfrastructure, formal and informal learning environments will be connected, eliminating the disconnected feel of physically removed field trips. The Exploratorium in San Francisco's Center for Informal Learning and Schools has a great Web site about informal science education (<http://cils.exploratorium.edu/cils/>).

Environmental stewardship is the responsibility for environmental quality shared by all those whose actions affect the environment (10). A bounty of current research, and probably your own observations, shows that children are very concerned about the global environment and how they can participate in its protection through conservation, recycling, and other awareness



activities (1). Two areas of environmental stewardship, nature deficit disorder and citizen science, are important science education trends for media specialists to watch.

Nature deficit disorder is a term from Richard Louv's 2006 book, *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder* (2). Louv argued that children are caught in a culture that promotes regimented sports over imaginative play. He contended that school curricula, reflective of high-stakes tests, teaches students about

science-related topics like endangered species, but does not encourage kids to experience the natural world in their own communities. Louv also wrote that children's constant use of technology has replaced their outdoor play experiences with virtual experiences and fostered a generation of stressed, attention span-impaired, sedentary children unaware of the interconnection between nature and survival. Louv takes a stance, controversially, that getting kids closer to nature in school and at home will not only address the childhood obesity epidemic, but will also help kids have longer attention spans and gain more personal confidence.

Citizen science engages volunteers in the collection of ecological information. In citizen science projects, students not only do the "grunt work" of collecting data that scientists can analyze to chart ecological trends, they also get to participate in the inquiry process by connecting phenomena to data and to changes in the environment. Citizen science allows

children to connect their desire to be environmentally aware and tech savvy, and to find ways to connect in-school and out-of-school activities with important global issues (9).

Citizen science projects use the Internet, SMS (texting), cell phones, and other Web 2.0 technologies to gather information about the environment. These technologies enable data collection for agencies and organizations dedicated to protection and study of the environment and promote the use

of kid-native, often unused-in-school technologies, in fun, relevant, and service-oriented lessons involving science, math, and other curriculum areas. For example, in the Neighborhood Nestwatch program (http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Research/Neighborhood_Nestwatch/), a collaboration between the Smithsonian Migratory Bird Center and the Cornell Laboratory of Ornithology, focuses on birds in the Washington, DC area but is about to go nationwide. Neighborhood Nestwatch volunteers work with scientists to find, observe, and compare bird nests in urban, suburban, and rural backyards.

The results of participant observations have already yielded valuable information about West Nile virus, lead contamination, songbird tracking, house wren behavior, and nest predation. Undoubtedly, the program has also inspired many of its child volunteers to become birdwatchers, ornithologists, or scientists in other areas.

HOW DO SCIENCE LEARNING INNOVATIONS RELATE TO SCHOOL LIBRARIES?

Our new AASL *Standards for the 21st-Century Learner* and *Empowering Learners: Guidelines for School Library Media Programs* are based on the principle that school libraries are more relevant than ever before and are the ideal context for children to explore their own interests and connect their school life with the outside world.

Science learning trends provide a wealth of avenues for school libraries and media specialists. We have the opportunity to bring forward some of our skills that we've been underemphasizing and use aspects of our expertise to support innovative learning. Here are some ways you can take advantage of science learning trends in your school library:

1 Be a broadband specialist. The philosophy of cyberinfrastructure has much in common with the new AASL standards and guidelines. My study about digital video mentioned earlier demonstrated that teachers and administrators are cautious about using new resources because they fear that the network capacity will be outstripped. I also found that, in many schools, this disconnect between perceived network capacity and actual network capacity became the responsibility of the media specialist to understand.

It's in your best interest to alert your science teachers to the cyberinfrastructure movement

and do what you can to make administrators and teachers aware of your network capacity and future needs. You can start by checking your network speed by using a tool like CNET's Bandwidth Meter Online Speed Test (<http://reviews.cnet.com/internet-speed-test/>).

2 Diversify your science collection. You've probably got some golden oldies in your 500s—get rid of them! Hanging onto them because you can't afford to buy new books? Learning objects are great, usually free, ways to freshen your science collection with resources that teachers probably don't know about and that kids will enjoy. You can find learning objects by looking through the "Resources for K-12 Teachers" area of the National Science Digital Library (NSDL) (http://nsdl.org/resources_for/k12_teachers/). There, you'll find pathways to learning objects including Teachers' Domain (mentioned earlier) and the Middle School Portal (<http://msteacher.org>).

But finding the learning objects is just a start. They need to be findable to everyone else! Instead of maintaining a "link farm" on your school library Web site or compiling handouts that are instantly out of date, catalog the individual learning objects into your catalog, just like you would a book or DVD. The metadata that comes with the learning objects will provide most of the catalog record information and most learning objects have individual links, so you can send users directly to them through the OPAC. If you catalog them, then your users can find the learning objects along with the books and videos in your collection.

3 Create a technology "safe zone." Another aspect of cyberinfrastructure and use of learning objects is technology policy in schools. The school library can be a technology "safe zone" where wireless can be enabled, students and teachers can have more access to computer functions, and potentially bandwidth-intensive applications like video can be used. In order to be part of the future of education, the future that is starting with science educations, media specialists must become vocal members of the technology policy-setting process. You will have to be a fearless advocate of technologies you haven't mastered and be willing to understand that experimentation is part of the social learning process. If you're willing to work with kids to transmit data they collect over the Internet,



use Web 2.0 applications to connect with the outside world, and look beyond filtered Web sites to gain more knowledge, then the enthusiasm and energy you create will help more timid teachers understand the importance of your technology leadership.

4 Connect your library to the outside world. If your school hasn't participated in a citizen science project like the butterfly tracking Journey North project (www.learner.org/jnorth/) or Neighborhood Nestwatch (mentioned earlier), then you can start your own citizen science project in your library and the libraries of nearby schools. You can ask kids to track birds or animals outside the library windows across seasons and exchange the information with other schools. You can even do something as simple as have students research the house plants media specialists keep in their libraries, why we keep house plants, and their benefit to our environment. You can exchange that information among schools. Philodendrons can be fascinating!

5 Model environmental stewardship. One of the easiest and most powerful ways you show that you are aware of new science education trends is to model innovative behavior. And one of the areas in which kids like to be involved is environmental conservation. What are you doing in your library to reduce consumption, reuse items, and recycle resources? Publicize your efforts inside the school and out and get kids involved. A great place to start helping kids understand how using the school library helps the environment is the Environmental Protection Agency's (EPA) Recycle City (www.epa.gov/recyclecity/).

CONCLUSION

It's time for school libraries and media specialists to be, as the Beastie Boys said in their rap classic *The Sounds of Science*, "dropping the new science and kicking the new ka-knowledge." The new era of education calls for a new style of school library and a new kind of media specialist. We must bring the trends to our teachers, enact the innovations with our students, and be brave in our assessments of the way we connect our libraries with the learning process. At the very least, we must know what's ahead for our children's educational experience and be able to speak the language of change. We've got the lyrics of learning down, but these educational innovations just might give you a new hook. 🌈

REFERENCES

1. Knapp, Clifford. "Reconnecting Children through Outdoor Education: A Research Summary." *The Journal of Experiential Education* 31.1 (2008): 95.
2. Louv, Richard. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Chapel Hill, NC: Algonquin Books of Chapel Hill, 2006.
3. Mardis, Marcia A. *Infusing Science into Middle School Media Centers: Obstacles and Strategies. A Final Report for the Institute for Library & Information Literacy Education (ILILE) National Research Grant Program*. Kent, OH: Institute for Library & Information Literacy Education (ILILE), 2004.
4. ---. "School Libraries and Science Achievement: A View from Michigan's Middle Schools." *School Library Media Research* 10 (2007). www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume10/mardis_schoollibrariesandscience.cfm.
5. ---. "Viewing Michigan's Digital Future: Results of a Survey of Educators' Use of Digital Video in the United States." *Learning, Media & Technology* 34.3 (2009): in press.
6. Mardis, Marcia A., and Ellen S. Hoffman. "Collection and Collaboration: Science in Michigan Middle School Media Centers." *School Library Media Research* 10 (2007). www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume10/collabandcollect.cfm.
7. National Science Board. *Science and Engineering Indicators 2008*. Arlington, VA: National Science Foundation, 2008.
8. National Science Foundation [NSF]. *Cyberinfrastructure Vision for 21st Century Discovery*. Arlington, VA: National Science Foundation, 2007.
9. Schibsted, Evantheia. "Kids Count: Young Citizen-Scientists Learn Environmental Activism." *Edu-topia* October 2007: 21-24.
10. United States Government Printing Office. *Sustainable Environmental Stewardship Good Business, Good Government*. Washington, DC: U.S. G.P.O., 2009.

Marcia A. Mardis is an Assistant Professor and Associate Director of the Partnerships for Advancing Library Media (PALM) Center at the College of Information & Communication at Florida State University. A former media specialist at a K-12 science magnet school in Texas, Marcia has developed her passion for linking school libraries and science learning in research projects for the National Science Foundation and Institute for Museum and Library Services. She was also one of the authors of AASL's Standards for the 21st-Century Learner.



IMPORTANT SCIENCE EDUCATION TRENDS FOR MEDIA SPECIALISTS TO TRACK

- **Cyberinfrastructure**—An approach to education that uses high speed networking to connect different formal and informal educational environments for lifelong, resource-rich learning.
- **Environmental Stewardship**—The belief that we all have a responsibility to protect the environment. The school library is a great place to model stewardship through conservation and recycling of paper and printing cartridges as well as to promote reuse through book checkout!
- **Learning Objects**—Digital objects that meet an instructional objective. They usually support a single concept or idea.
- **Citizen Science**—The use of everyday citizens, including children, to collect scientific data about plants, animals, and the environment. Citizen science projects often use technologies like cell phones, Web sites, and Web 2.0 applications to receive the collected data.

